THESIS

A GREENER PLAN FOR PUBLIC HOUSING: A STUDY OF COLORADO HOUSING AUTHORITIES' UTILIZATION OF GREEN BUILT TECHNOLOGY

Submitted by

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ABSTRACT

A GREENER PLAN FOR PUBLIC HOUSING: A STUDY OF COLORADO HOUSING AUTHORITIES' UTILIZATION OF GREEN BUILT TECHNOLOGY

Reducing energy usage, or at least controlling energy consumption, is an important goal for Colorado Housing Authorities (CHAs). Additional goals include preventing the escalation of property rents (i.e., energy costs), as well as controlling administrative costs that result from high energy usage. Observational data, however, suggests that only a limited number of CHAs have undertaken energy conservation measures. This study examines current energy savings program implementation among CHAs. More specifically, the study will investigate how CHAs incorporate energy efficient technologies into existing facility maintenance as well as new property construction. Currently, information identifying a baseline of energy conservation by CHAs does not exist, and is the motivation of this study. Baseline energy conservation data will assist CHAs, as well as funding agencies, to identify current levels of technology implementation to use as a planning tool for current and future energy projects. The proposed methodological approach will incorporate the use of a census design, which will examine current attitides, beliefs, opinions, and practices of CHAs.

ACKNOWLEDGEMENTS

After graduating from Colorado State University in 1971 with a BA, I never imagined I would return 40 years later to once again enter into the world of academia. But as fate would have it, I did return to earn my Master's of Science in Construction Management and it has been an adventure. One class at a time and then it is finished.

Of all the encouragement I have received I especially wish to thank my wife Sara, my biggest supporter. Sara never doubted I could, and would, complete my degree. She sacrificed our family time together while encouraging me to spend the time necessary to finish my assignments. Without Sara's love and help I could not have succeeded.

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CHAPTER 1 – INTRODUCTION

One of society's strategies to meet the challenge of global warming is to implement sustainable design and environmentally-sound technological innovations (Creyts, Derkach, Nyquist, Ostrowski, & Stephenson, 2007). According to Casale (2006), increased energy use in America has created incentives for consumers to explore new means of increasing energy efficiency and reducing overall energy usage. Sustainable design can benefit the environment, the economy, and political and social conditions.

Green Building is also referred to as "sustainable building" or "environmental building." For the purpose of this paper the definition of sustainable building construction is that which minimizes negative impacts on the environment and human health and is designed for the most efficient energy and resource use. Green building is an ever evolving technology that is becoming more economically viable both for construction and "Life Cycle Costing." Life Cycle Costing is defined as the total cost of ownership during the life of an asset, also commonly referred to as "cradle to grave."

Controlling the consumption of energy is an important goal for public housing authorities (PHAs). Controlling energy consumption can help control the escalation of property rents, which result in part from increased energy and administrative costs. Colorado's Rocky Mountain location, characterized by moderate climate, sunny days, wind, mild temperatures, and rivers and streams, creates a unique opportunity for Colorado Housing Authorities (CHAs) to utilize a variety of energy sources such as solar, wind, and geo-thermal. Use of such sources can result in substantial energy cost savings.

Observational data, however, suggests a minority of CHAs have undertaken such energy saving techniques.

Assuming these observations are correct, CHAs are missing out on potentially significant energy saving opportunities. One possible reason for this apparent lack of implementation is that CHAs have many competing goals and limited financial resources from which to draw. As a result, they generally focus their resources on their core purposes of filling vacant units, making repairs, and assisting the residents. Additionally, many CHAs pay the utility bills for their residents even though the cost of energy continues to increase yearly. This is an ongoing financial challenge for CHAs as higher energy payments reduce the ability of the CHA to maintain and/or improve properties. These utility payments should act as a fiscal motivation to conserve energy. High energy usage is also a factor in the ability of the CHA to stablize, or even reduce, rents. Green technology efficiencies and green buildings generate financial savings in the form of reduced expenditures on energy and lower operations and maintenance costs for buildings.

Building green housing has numerous societal, economic, and environmental benefits. The stakeholders and/or recipients of these benefits may vary. For example, direct economic benefits can exist for residents, for CHAs, for developers of the housing, and for tax credit investors. There are also indirect benefits at the community, local, regional, and global levels. Some of the positive benefits are tangible and measurable, such as energy usage and cost, while others—improved health, comfort, well-being, and feelings of pride—can be more difficult to measure. According to Landman (2009), direct and indirect benefits to various stakeholders include:

- *Resident Benefits:* Lower energy and water bills, healthy living environment, and a healthier lifestyle.
- *Developer/Owner Benefits:* Competitive advantage for receiving low-income housing tax credits, which are increasingly weighted towards green measures, as well as green rebates and other financial incentives; community good will and positive public relations; operating cost savings (on utilities, maintenance, and replacement costs); and reduced liability risk from building-related health problems that result from chemical and biological contaminants.
- *Investor Benefits:* Recognition in the marketplace for environmental leadership and stewardship; community good will and positive public relations; strong long-term returns; and potential for increased building value.
- *Community Benefits (local and regional):* Reduced burden on municipal infrastructure (e.g., landfills, water supply and treatment, and storm water management systems); reduced air and water pollution; reduced sprawl; healthier populace; and healthier working environments for construction, maintenance, and manufacturing workers.
- *Environmental Benefits (local, regional, and global*): Water conservation; protection of air and water quality; reduced greenhouse gas emissions; reduced contribution to climate change; habitat protection; natural resource conservation (e.g., more sustainable forest management); and reduced waste.

This study outlines current energy program implementation among CHAs. More specifically, it evaluates CHAs' level of involvement in utilizing energy efficient technologies with regard to maintenance of existing facilities and the construction of new

properties. Recent increases in energy costs have led to increased operating costs for CHAs. While CHAs cannot control the cost of the utilities, they do have the ability through capital improvements and education funded by grants and other funding mechanisms, to influence the usage of utilities by residents.

To better document and to understand this lack of implementation, it is first necessary to determine the current levels of implementation. To better understand current implementation by CHAs, this study will focus on identifying current utilization of energy and green technologies in CHA facilities. More specifically, this research will focus on both the behaviorial and technical aspects of funding, education, building design, and maintenance programs implemented by CHAs.

Study Background

Venolia and Lerner (2006) note that with a history of ample supplies of inexpensive energy, America has lost sight of efficiency as a cornerstone of energy use, generation, and distribution. Energy conservation equates to the notion we can generate less energy to meet the same needs, resulting in reduced infrastructure needs and investment. Common sense dictates that CHAs are expected to be good stewards of energy usage and it can be assumed that CHAs believe long-term economic and environmental sustainability starts with energy efficiency in building systems. This researcher found little evidence, however, to support this expectation locally or nationally.

CHAs also have the opportunity to capitalize on the implementation of green technologies to reduce energy comsumption of their properties through education and financing for energy projects. Current literature and casual observation, however, suggest

that CHAs are not implementing green strategies, leading to the research question of why a gap between opportunities and implementation exists.

In April 2000, Robert Groberg published the *Energy Desk Book for HUD Programs* (*Energy Desk Book*). The *Energy Desk Book* discusses the heavy burden utility costs can place on housing, which was estimated to be more than one billion dollars in 1999 (Groberg, 2000). Groberg reviewed important energy mandates for HUD programs and discussed resources available to reduce these costs for American families and communities. By improving energy efficiency, HUD can help Public Housing Authorities (PHA) save money they otherwise would need to spend on energy—freeing up these precious dollars for food, shelter, and other necessities. The directives outlined in the *Energy Desk Book* set the standards for improving energy efficiency in public housing. Whether involved in designing, specifying, planning, building, or installing, the *Energy Desk Book* provided guidance to ensure that developments were successful controlling energy usage—whether newbuild or refurbishment—and performing to the highest energy efficiency standards.

Research Question

Information identifying a baseline of energy conservation by CHAs is absent, thus emphasizing the need for this study. Information obtained for the study will assist CHAs, as well as funding agencies, to identify current levels of technology implementation.

The underlying research question to be answered by this research was "What is the current state of energy conservation of CHAs?" It was the purpose of this research to establish a baseline identifying the level of participation of CHAs in managing energy

usage through the implementation of energy technology, funding resources, and education of residents and employees.

Establishing the baseline information outlined above will aid CHAs and funding partners in their short term technological, educational, and financial needs analysis as well as establish a basis for long term planning in energy conservation.

With this in mind, individual areas explored included:

- *Why are some CHAs more actively involved in energy conservation?*
- *What types of energy funding have individual CHAs applied for, if any?*
- *What is mainintenance's involvement in past or future energy property upgrades?*
- *How are projects prioritized, i.e. energy conservation, resident needs, etc?*
- *Has the CHA contracted third party energy consultants?*
- *Is property energy usage measured and, if so, how is it measured?*
- *Is energy information shared with the CHA residents and employees through an educational process?*

An additional area to be explored was the concept of third party consultants. Part of committing to a progressive energy program is the utilization of engineers and architects who demonstrate an advanced level of expertise in the area of Green Build technology. Advances in energy related technology are made daily and, although expensive, the use of the third party consultant can provide CHAs with information they can use in making decisions on what products are best for their projects. It is understood architects and engineers are utillized when designing new construction, but are they consulted on smaller energy projects?

Delimitation

According to Housing Authority USA (2010), there are more than 1,900 PHAs in the United States. This study, however, focused only on PHAs in the state of Colorado due to the availability of research resources and time. Even within this limited area, the scope was challenging due to the number of CHAs in the state and the geographic diversity of each authority's location. This survey included 88 CHAs identified in the Colorado Public Housing Authority Directory prepared by the Department of Local Affairs, Colorado Division of Housing (Appendix A).

The study consisted of a list of questions related to the total energy usage of the CHAs, for example, natural gas and electrical units, not the costs billed by the utilities. Energy usage is controllable through improvement of facilities, either at the design stage for new construction or through the use of improved energy procurement for existing facilities. CHAs may also control energy usage through resident endcation and behavior modification. CHAs, however, cannot control the rates charged for the energy.

Researcher's Perspective

This research project is the result of this researcher's association with both construction and CHAs. This researcher's tenure as the maintenance supervisor for a CHA began in 2006. It was at this time he became aware of the apparent lack of initiatives to upgrade properties using the latest energy efficient technologies. Although the interest in reducing energy usage existed in the CHA community, the processes involved in securing financing for projects—whether federal, state, local, or internal—created a significant stumbling block. The lack of educational programs for CHA

employees and residents as to the importance of conserving energy was also called into question.

During the past 35 years in construction, this researcher has experienced the growth of the Green Movement, both as an observor and as an active participant. As the maintenance supervisor for a CHA, the researcher realized there was a need for programs that involved the inclusion of a green policy. As the researcher became more involved in this research project, it was evident there was very little information directly related to energy and the involvement of the Affordable Housing Industry in Colorado.

CHAPTER 2 – LITERATURE REVIEW

This literature review identified a significant amount of research relating to the various methods of "build green," sustainability, and their relationship to saving energy. There was a lack of available research, however, that addressed saving energy as it is directly related to CHAs.

The literature review is organized into the following sections: (a) Defining "Green" (b) HUD Encourages "Green" Public Housing, (c) Energy Efficiency and Eco Friendly Affordable Housing Attributes or Strategies, and (d) What the Future Holds.

Defining "Green"

The vision of a green movement within the public housing industry started to take shape in 1982 at Enterprise Community Partners, Inc., an investment company for public and private affordable housing (Landman, 2009). Green affordable housing has long been considered an oxymoron, considering the high cost of green technologies, which explains why affordable builders have struggled to change. Until recently, ecologically-oriented construction has mostly been limited to federal and state government subsidized projects, high-cost developments, and individual construction by individuals and businesses with sufficient resources to fund superior technology and avant-garde solutions to environmental problems (Landman, 2009).

Green building may incur more up-front costs to attain long-term sustainability goals, and as such green building first costs may be a barrier for low-income housing (Thompson, 2008). The return on investment (ROI) for sustainable products many times

does not make good fiscal sense and sustainable products are omitted from designs for low-income housing projects. A good example is the use of solar energy, whether it be hot water storage or photo voltaic. Upfront costs for a solar project, not considering grants, can be more than a CHA can justify for their ROI schedule.

On another front, the "co-housing" movement, a trend toward integrated village-like shared housing, has demonstrated that achieving high levels of sustainability without sacrificing building quality is possible through dedicated community decision-making and planning (Dean, 1999). The co-housing concept has raised some interest with CHAs as another means of providing affordable housing to the public, in particular the senior community. According to Dean (1999), some co-housing developers and property management companies have accepted government funding in exchange for opening units within their development to lower-income households; these are a rarity in the private sector of housing management.

Co-housing has been used in an 85-unit development by the Cambridge Housing Authority, Cambridge, Massachusetts (Dean, 1999). The development includes two units purchased for low-income rentals. Going beyond conventional design, the Cambridge Housing Authority group is committed to a super-healthy indoor environment, the re-use of industrial sites for housing, solar energy, access to and use of public transportation, and diversity.

In Colorado, as green building becomes the norm rather than the exception in mainstream building practices (SWEEP, 2010), Green Build is evolving in design and construction of market rate units/developments where reduction in the use of energy has become an important design component, including saving natural resources, reducing the

carbon footprint, and reducing costs. To date, there is little evidence of green technology application within the CHA industry.

HUD Encourages Green Public Housing

Every year the U.S. Department of Housing and Urban Development (HUD) encourages PHAs and tribally designated housing entities (TDHEs) to recognize October as Energy Awareness Month. As the overseer of affordable housing in the United States, by this action HUD demonstrates that they regognize the importance of PHAs controlling costs through energy efficiency.

Currently, utility costs make up approximately 24% of the operating expenditures for PHAs (Department of Housing and Urban Development [HUD], 2010). To show their commitment to energy conservation, HUD issued a notice encouraging the country's 3,200 PHAs to use green strategies whenever they build, renovate, or maintain housing projects. Boehland wrote that "HUD is always looking for ways to assist housing agencies in reducing utility operating costs and leveraging resources" through energy conservation and resources of renewable energy. The HUD "green strategies" notice to PHAs nationwide is "a natural extension of HUD's ongoing energy efficiency efforts" (Boehland, 2008, p. 1).

HUD had two objectives in issuing the notice. The first objective was to introduce renewable energy sources to PHAs as an approved fossil fuel energy conservation measure. The second objective was to remind PHAs that renewable energy can be funded under HUD's 24 CFR 990.185 incentive programs (Venolia & Lerner, 2006). HUD also allows PHAs to implement renewable energy and other green strategies as long as affordability and availability of housing are not adversely affected (Boehland, 2008).

This may include either "first cost," initial construction cost, or "life-cycle cost," the cost over the life of the project. Finally, HUD allows PHAs to use the savings resulting from energy conservation and generation strategies to amortize—over a period of up to 20 years—the up-front cost of implementing those strategies (Venolia & Lerner, 2006).

Several PHAs, including those in Boston and Philadelphia, are already incorporating sustainable strategies into the construction and rehabilitation of their housing projects. Specific strategies include new hot water and heating systems and the installation of new efficient exterior lighting. Through ambitious public/private partnerships, the Boston Housing Authority (BHA) will recapture $16 million in energy savings over a 10-year period by installing new energy and water systems in seven BHA-owned developments that will improve the quality of life for thousands of BHA residents. Overall, energy-efficiency and renewable-energy measures contribute to the decent, safe, and sanitary housing for residents and valued property assets for the local community (Flores, 2007).

A new emphasis must be placed on understanding the importance of government and private funding agencies who subsidize CHAs' efforts to reduce energy usage through grants and loans. Without these funding agencies, it must be assumed that progress in energy conservation would not exist to the extent it does today (Flores, 2007). The State of Colorado, through the establishment of the Governor's Energy Office (GEO), is a major contributor to CHAs' abilities to improve the energy effieciency of affordable housing; HUD and the Federal Government also play a large role in providing grant funding to CHAs. According to an article published in the Denver Business Journal on February 15, 2009, titled "*Stimulus Package: A Colorado Breakdown"*, the "American

Recovery and Reinvestment Act (ARRA) of 2009" invested in Colorado's CHAs with a significant amount of funding for energy. To what extent individual CHAs invested a portion of their ARRA funds in energy conservation is not known. The investments were as follows:

HOUSING:

- $27.4 million to state and local governments to acquire, construct, and rehabilitate affordable housing and provide rental assistance.
- $17.7 million through the Public Housing Capital Fund to public housing agencies to fund energy-efficiency upgrades and other infrastructure improvements for public housing and low-cost housing.
- $15.6 million through the Homelessness Prevention Fund for rental assistance and utility payments.

ENERGY:

- $81.1 million through the Weatherization Assistance Program, which helps low-income families lower their energy bills by making their homes more energy efficient.
- $49.1 million through the State Energy Program, targeting research and development of clean renewable energy and modernizing energy transmission.

Energy Efficiency and Eco Friendly Affordable Housing Attributes or Strategies

Construction design criteria for new and existing projects are an important element of the green build strategy. These criteria can be developed through the use of third party designers. Third party designers such as engineers and architects can be

engaged on an individual basis or in a design charette to design an energy efficient product.

When choosing to build affordable housing, size and shape can greatly influence the eco-friendliness of the home. Choosing an excessively large home reduces energy efficiency and increases the impact on the environment. A greener choice for affordable homes would be to provide a comfortable living condition with less raw material and energy consuming space (Flores, 2007) than the average 2,438 square foot single family home built in 2008 in the United States (U.S. Census Bureau, 2009). The shape of the home can increase the efficiency as well; more dome shaped homes are being built today than ever before (Flores, 2007).

Energy efficiency is a major contributor to energy conservation. Energy efficiency has become the mantra on many levels of the building industry and has been embraced by government and private enterprise as a means to affect the costs of running a household (Russell, 2006). This is evident through government tax rebates for the purchase and installation of energy efficient appliances, windows, and insulation, as well as priority mortage interest rates given to energy efficient home buyers.

There are numerous ways to make housing more energy efficient. Energy efficiency can be achieved through installing insulation, using energy efficient windows and doors, and replacing old inefficient appliances with newer energy efficient appliances. Insulating a home can reduce energy use by up to 50%. Options for insulation materials include a variety of environmentally sensive products such as recycled denim and cotton insulations (Easton, 1996). Replacing windows and doors in a home can also increase efficiency and energy conservation as well. There are many ways

to improve the eco-friendliness of an existing home even when funding is not available for extensive remodeling or building modifications. Examples include adding new *Energy Star* appliances, sealing and caulking windows, and sealing exterior wall electrical outlets (Easton, 1996). Energy efficient *Energy Star Rated* appliances are readily available to CHAs.

Energy is only part of the "Green Build" equation and sustainable development criteria must be included in all aspects of building that incorporate principles of sound land use planning. These principles include minimizing impact on the environment; conserving natural resources; encouraging superior building design to enhance the health, safety, and well-being of residents; providing durable, low-cost, low-maintenance dwellings; and making optimum use and preservation of existing infrastructure (Buchanan, 2005). Designs meeting these standards, with the application of reasonable public subsidies, may be widely replicated by affordable housing developers (Buchanan, 2005). The involvement of public subsidy has been furthered by passage of the Economic Stimulus Act of 2008 and the American Reinvestment and Recovery Act (ARRA) of 2008, which emphasized improvement in the energy efficiency of CHAs; it is not evident that CHAs are taking advantage of these funds.

A long-term goal of the affordable housing industry, including housing authorities, is to raise the standard of development to reflect sustainable criteria through creative approaches, for example, energy efficient technologies (Bower, 2008). Bower observed there was a concerted effort to produce a template and consensus of best available options to conserve energy in the affordable housing industry. Technology is a critical element in defining the challenges to affordable housing builders. Included in

Bower's available options is to make energy options and new technology commonplace, universally accepted, globally available, and locally applicable so the technology becomes cheaper and easier to use (Bower, 2008). Bower emphasized that as the guesswork of a holistic approach lessens, the options to increase energy efficiency will dominate the marketplace resulting in lower costs and quelling criticisms that sustainability is for an upscale market only (Bower, 2008).

What the Future Holds

Energy conservation is the blueprint for the future. Energy conservation is now essential for addressing climate change, improving our energy security, and controlling costs for the end user. It is important that CHAs, in building new structures and maintaining older properties, take advantage of every opportunity to reduce energy consumption. This is not only environmentally sound, but with rising costs it is also fiscally responsible (Nichels, 2005).

Funding opportunities exist to improve CHA energy programs through physical replacement of building components—furnaces, waterheaters, boilers—and through the education of CHA employees and residents. What is not known is how many CHAs are, or are not, utilizing energy funding and educational opportunities to reduce their energy usage. In addition, it is not known why some CHAs are at the forefront of controlling or reducing energy usage, while other CHAs are lagging behind in the "Green Build" movement. The information gained from this study will help define the different opportunities available to CHAs to help move them towards energy efficiency.

CHAPTER 3 – METHODOLOGY

The methodology used for this research project was based on a mixed methods research design—a procedure for collecting, analyzing, and "mixing" both quantitative and qualitative data in a single study (Creswell, 2005). A mixed-methods design provided a deeper understanding of the data collected.

The proposed methodological approach incorporated the use of a census survey design, which examined current attitides, beliefs, opinions, and practices of all CHAs identified by the Colorado Division of Housing (DOH) (Appendix A).

The information gathered facilitated identifying sustainable CHA consumption patterns with general descriptors and indicated the degree of energy conservation of the surveyed CHAs. The information gathered allowed the identification of sustainable housing consumption patterns with general descriptors and gave an indication of the degree of CHA involvement in the areas of interest (Creswell, 2005).

Development and Pilot Study

Data was collected from a survey sent to 88 CHAs located in Colorado. A survey (Appendix B) and cover letter (Appendix C) were e-mailed to the CHAs. At the 2009 National Association of Housing and Redevelopment Officials (NAHRO) seminar in Breckenridge, Colorado, a pilot survey was presented to 12 individuals employed with CHAs, energy, and financial industries, for their review and comments. Changes in the instrument were based on the feedback received from the individuals who completed and evaluated the instrument. The participants made written comments directly on the survey

and the researcher made several modifications to reflect those concerns. According to Creswell (2005), the researcher should expect a "response return rate" of 50% or better. As this topic is important to all CHAs, it was hoped that people would be willing to spend the time and effort necessary to participate. In developing this research project, several CHAs expressed interest in the results of this survey.

The purpose of this survey was to evaluate the level of involvement of CHAs in the utilization of energy efficiency technologies with regards to both the maintenance of existing facilities and the construction of new properties. The survey covered 24 months, a time period that included the American Recovery and Reconstruction Act, the present, and future involvement of CHAs in energy decision making. Areas of interest included: CHA funding and grant writing efforts, CHA energy conservation, education of CHA employees and residents, CHA consideration of alternate energy sources, CHA use of third party energy consultants, and CHA types of energy consumption monitoring, if any. The research questions were divided into eight divisions as shown in Table 1.

Table 1

Survey Outline

Survey Divisions	Corresponding Survey Questions
General property information-questions	1, 2,3 ,4, 5
Project Funding-questions	6, 7, 31, 32
Energy Projects: Past, current and future-questions	8, 9, 10, 11, 12, 15, 16
Prioritizing Energy Project-questions	13, 14
Third Party Consultants-question	23
Energy usage responsibility-questions	17, 18, 19, 20, 21, 22

Education and incentives- questions	24, 25, 26, 27, 28, 29, 30
Comments from CHAs	33, 34

The general property information questions set the parameters for how the final data was reported and the remaining questions addressed the important issues of CHAs' role as energy stewards. For example, a small CHA with one 25-unit multi-family property, funded through tax credit financing, would not be eligible for certain funding grants. Securing adequate funding resources for energy related projects is as great a challenge for CHAs as it is for industries in the private sector. Important questions for the CHAs are what funding resources are available to them, who manages those resources, where are funding resources found, and how are the funds secured. Anwering the questions as to the extent of knowledge the CHAs have concerning the what, who, where and how to obtain energy funding will promote future projects. The data should also show how improved funding sources will aid in an increase of efficiency of public housing properties and lower daily operations energy usage.

Using quantitative analysis, the survery questions were analyzed to determine the different levels of involvement of CHAs in efficient utilization of energy and new technology in facilities maintenance, remodeling and new construction, and education programs. The survey questions were designed to assertain in part if (a) CHA managers and staff are knowledgable on the subject of energy usage at their properties, (b) CHA management teams measure energy usage and how is that accomplished, and (c) energy usage information is shared with residents as well as other members of the CHA.

By identifying the dollars spent, construction and maintenance priorities can be determined. Important questions must be answered when making decisions related to the funding of energy related projects. These are all valid questions when projecting how limited CHA funds are to be allocated and the answers must reflect the best interest of the CHA and their residents.

Summary of Analysis Procedures

The survey was sent electronically to the CHAs using Survey Monkey. For CHAs with no e-mail address a packet containing a cover letter, the questionnaire, and a self-addressed, stamped return envelope was sent. Two follow-up strategies were used to increase the response rate. First, a physical packet with a recruitment letter and the survey was mailed to non-responding participants after two weeks. Second, after three weeks researchers called non-responding CHAs and offered to assist them with completing the survey by allowing them to complete the survey verbally. The targeted respondent for each CHA was an employee of the CHA with extensive knowledge of the CHA's physical operations (e.g. executive director, director of maintenance, maintenance supervisor). The cut off occurred after an additional two weeks. The total time allowed for a response was three and a half weeks.

Descriptive statistics were used to describe the main features of the collected data. Qualitative responses were coded to identify trends in qualitative data.

CHAPTER 4 – RESULTS

Introduction

The results of the survey data collection are organized into divisions as outlined in Table 1, *Survey Outline*, located in Chapter 3. One additional section was included, Survey Response, which describes the response data. Each of the following sections describe the responses received from the CHA population that responded to the survey questionnaire.

Survey Response

The survey instrument was sent to 88 CHAs utilizing both email and the U.S. Postal Service (USPS). The USPS was used to send 15 surveys as the researcher did not have access to an e-mail address. The remaining 73 survey instruments were sent utilizing the online survey software SurveyMonkey. Of the surveys sent, the researcher received 2 responces via the USPS and 22 responses from SurveyMonkey. Of the 88 CHAs surveyed, it was determined that 47 did not own or manage physical properties. This was determined by CHA survey responses, followup phone contact, and information received from National Association of Housing and Redevelopment Officials (NAHRO) Colorado Chapter. Of the remaining 41 CHAs, 22 (53%) responded that they manage and/or own physical properties.

General Property Information

Seventeen CHAs reported between 0 and 400 multi-family units; four CHAs reported more than 400 units. CHAs with less than 400 units reported between 0 and 364

units; CHAs with greater than 400 units reported 447 to 926 multi-family units. The number of CHAs reporting single family units was 15, accounting for a total of 54 single family units. The total number of units represented was 4,539.

Funding of the properties was divided into three areas: self-funded, tax credit funding, and public housing (HUD). CHAs received most of their funding through HUD; 18 of the 22 responding CHAs received 81.8% of their property funding through HUD. Twelve CHAs received 54.4% of their property funding through private agencies or owned the properties, and nine CHAs finance 40.9% of the properties through tax credit funding instruments.

The number of both single family and multi-family units for the 22 responding CHAs totaled 4,006 units. The ages of the property units are shown in Table 2.

Table 2

Age of Units

Age of Units (years)	No. of Units	Percent of Total Units
0-5	717	15.80
6-10	662	14.58
11-15	358	7.88
16-20	330	7.28
21-30	679	14.96
31+	1,793	39.50

The number of units exceeding 15 years in age was 2,802, or 61.73%, of the total units in service at the time of the survey.

Maintenance of the CHA multi-family and single family properties was divided into three options: maintenance performed in-house, for example property management; maintenance contracted out to a third party; and a combination of in-house and outside contracting. The majority of the CHAs, 72.7% (*n*=16), performed their primary maintenance in-house while 18.2% (*n*=4) reported that maintenance was a joint effort utilizing in-house personnel combined with outside contractors. Only 9.1% (*n*=2) of the CHAs reported using outside contractors exclusively.

Project Funding

An important funding resource for any energy project is grant writing, whether applying to federal, state, or local government agencies, or a private funding agency such as Energy Outreach Colorado. Participants representing 3,875 housing units largely responded in the affirmative; 68.2% (*n*=15) with regard to actively writing grants or soliciting funding for energy projects. However, 31.8% (*n*=7) of the responding CHAs, representing 454 housing units, were not actively involved in writing grants and/or soliciting funding for energy projects. Of the 454 units, 88% (402 units) were 20 plus years old. The percentage of CHAs who responded they were not involved, 50.0% (*n*=3), acknowledged they were not knowledgeable of funding resources. Of the CHAs not actively writing grants, one stated they did not meet specific funding qualifications, such as matching funds for a project. One participant also responded that there were "Other" reasons for not writing grants; the reasons were not elaborated upon.

If a CHA does not actively write grant applications or solicit funding for energy projects, it is important to know some of the reasons. Survey participants who answered

the question as to why they did not apply for grants or solicit funding for energy projects gave responses as shown in Table 3.

Table 3

Reasons For Not Writing Grants/Pursuing Other Sources of Funding

Response	**% of Responses**	***n***
Not knowledgable of funding resources	50.0	3
Do not have fund writing abilities	16.7	1
CHA does not meet specific funding qualifications	16.7	1
Other	16.7	1

"Matching funds" are that necessary portion of a project's financing made available by a CHA. Different grant funding agencies require CHAs to provide a portion or percentage of the total cost of the project to qualify for funding. The matching funds can come from different sources within the CHA: operations accounts or funds budgeted for the yearly operation of the property; reserve accounts or a type of savings account; or an excess rent account, the CHA's portion of rents collected above Fair Market Rent (FMR). The survey asked the CHAs to identify all of the types of matching funds available, as more than one type of funding might be available to the CHA; participant responses are shown in Figure 1.

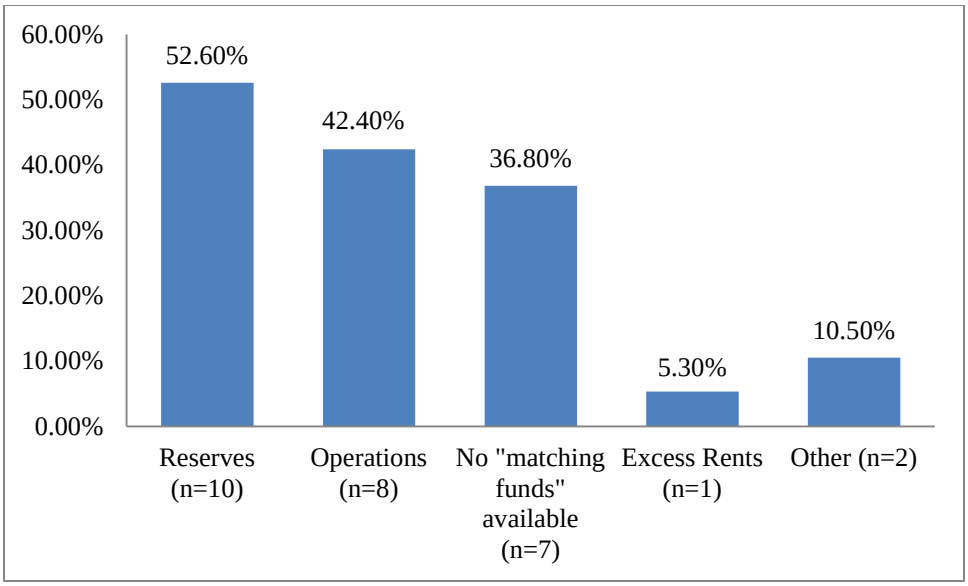

Figure 1. Sources of Matching Funds

Survey Question #14 (Appendix B) addressed implementation of projects and could be analyzed in either the Project Funding or Education and Incentives divisions, as the question had components relating to both. CHAs were to check the best reason why they have not implemented projects designed to reduce energy consumption. Figure 2 illustrates the results.

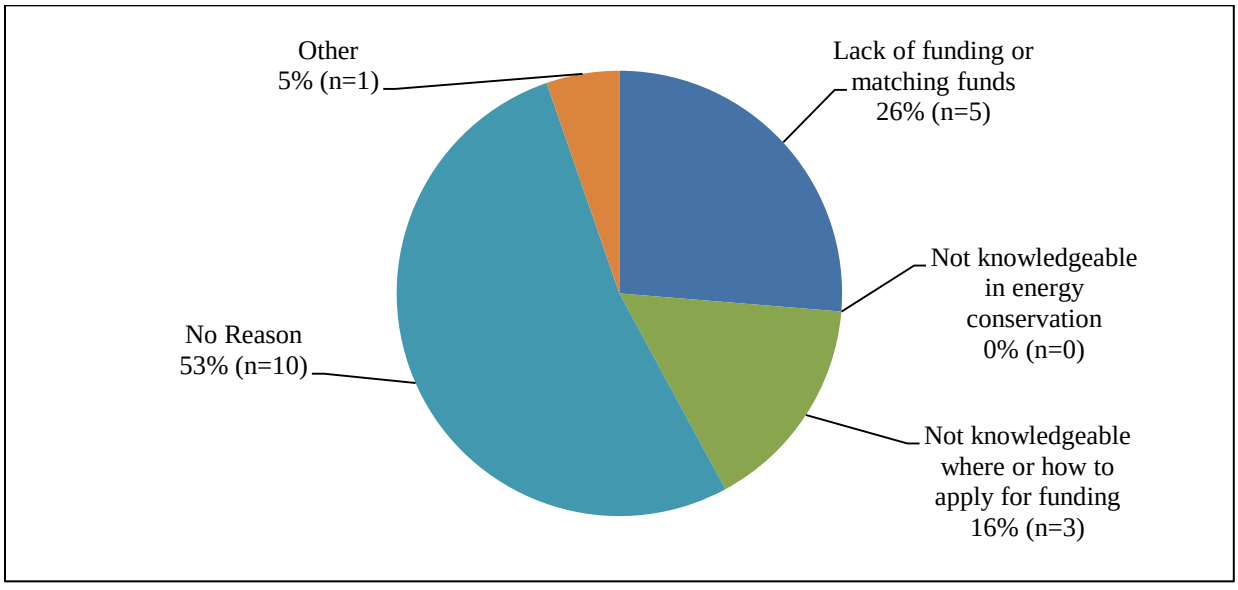

Figure 2. Reasons for Not Implementing Energy Projects.

Energy Projects: Past, Current, and Future

The CHAs were asked to respond to questions identifying how energy projects have typically been funded. A list of alternatives was presented, as well as the optional "Other," with the request to specify the funding source. The CHA was asked to identify all sources of funding. For example, 35% (*n*=7) of all respondents identified Governor's Energy Office as a source of funding. The results are shown in Table 4.

Table 4.

Energy Project Funding by Source, Number, and Percentage of Respondents

Source	# of Respondents	% of Responses
Governor's Energy Office	7	35.0
Energy Outreach Colorado	8	40.0
Colorado Department of Local Affairs	3	15.0
Community Development Block Grants	7	35.0
Energy and Environmental Block Grants	3	15.0
Housing and Urban Development	9	45.0
Have not received funding	3	15.0
Other	4	20.0

The "Other" sources identified by the respondents were: ARRA, Energy Performance Contract, Local Foundations-Sprout Foundation, and Weld County Grant.

No specific time was designated for Question #8 (Appendix B) so information was requested for funding of energy projects within the past 24 months. The 24-month designation covered a reasonable past where information would be relevant and readily available to the respondents. Fewer funding resources were identified when a time limit was specified as shown in Table 5.

Table 5.

Last 24-Month Energy Project Funding by Source, Number, and Percentage of Respondents

Source	# of Respondents	% of Responses
Governor's Energy Office	6	30.0
Energy Outreach Colorado	9	45.0
Colorado Department of Local Affairs	2	10.0
Community Development Block Grants	6	30.0
Energy and Environmental Block Grants	2	10.0
Housing and Urban Development	7	35.0
Have not received funding	4	20.0
Other	5	25.0

The "other" sources identified by the respondents were: ARRA, Energy Performance Contract, Local Foundations-Sprout Foundation, Weld County Grant, and bank financing.

A comparison of the types of funding received (Series 1) and funding received in the past 24 months (Series 2) is depicted in Figure 3.

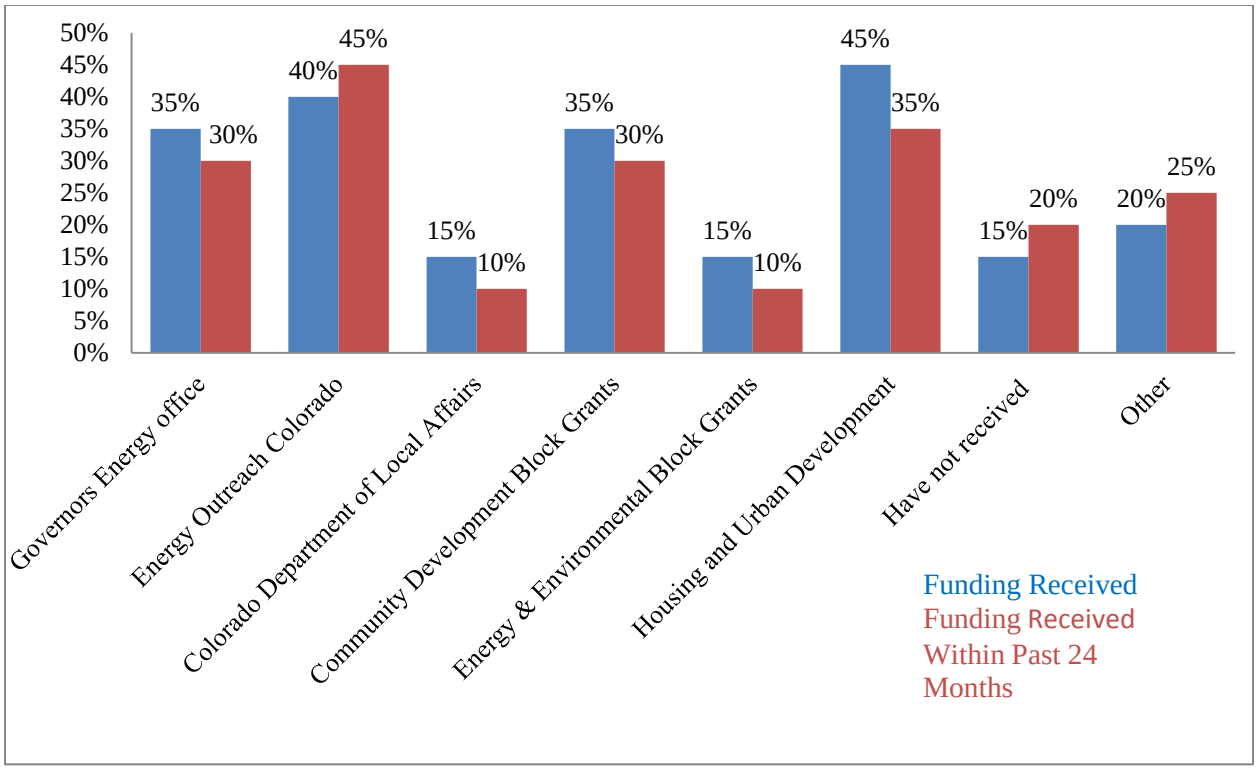

Figure 3. Energy Funding—Recent and Within Past 24 Months

Survey Question #32 (Appendix B) discussed the CHAs' usage of ARRA funds received as part of the Federal government's stimulus program. If a CHA received ARRA funds, were any of those funds allocated to energy projects? Survey participants responded with an equal percentage of "yes" and "no" responses, 47.4 % respectively; a small number, 5.3% (*n*=9) answered "neither."

The survey asked participants to rate the importance of replacing old inefficient appliances with *EnergyStar* rated applications using a level of importance ranging from "Not Very Important" to "Neutral" to "Very Important" in response to the question "How important is it for you to use EnergyStar rated appliances when replacing appliances?" The responses are shown in Figure 4.

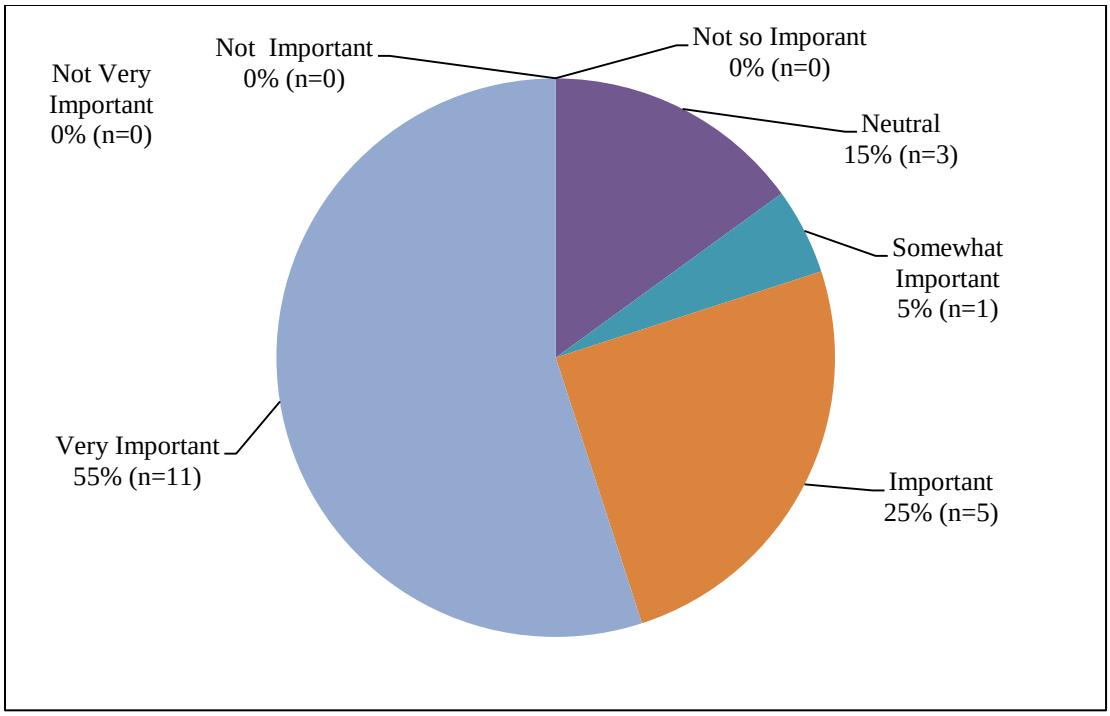

Figure 4. Importance of Using Energy Star Appliances

The data suggests the best single reason for not purchasing *Energy Star* rated appliances in the last 12 months was the cost of the appliance. Of the 20 responses to Question #11 (Appendix B), six CHAs answered cost was a factor for not purchasing *Energy Star* appliances, four CHAs responded "N/A," seven CHAs purchased *Energy Star* appliances, and three CHAs already have newer appliances and have not purchased appliances in the past 12 months.

Of the participants responding to survey question #12 (Addendum B), 80% (*n*=16) indicated they had implemented projects to reduce energy consumption and 20% (*n*=4) stated they had not. In comparison, question #15 revealed nearly 90% (*n*=17) of the participants indicated that they had not implemented an energy-related project in the past two years that was not expected to reduce energy consumption, for example, furnace or water heater replacement.

Question #16 (Appendix B) asked the CHAs if they had, when implementing an energy related project, not expected to reduce energy consumption, and if an energy saving alternative, such as 95% efficient versus 80% efficient furnance, was considered in the decision making process. Of the responses, 47.1% (*n*=8) stated they had considered energy efficient appliances while 52.9% (*n*=9) have not implemented energy projects that are expected to reduce energy costs.

Prioritizing Energy Projects

Question #13 (Appendix B) asked the CHAs to identify the types of projects they have implemented, how they evaluate energy projects, and how the projects are prioritized. The CHAs were given a list of types of projects and asked to identify all of the identified project types they have implemented; responses are shown in Table 6.

Table 6.

Types of CHA Energy Implemented Projects and Percentage of Respondents

Type of Energy Saving Projects	# of Respondents	% of Respondents Who Have Implemented
Lighting projects (i.e. CFLs, T-12 conversions)	11	73.3
Conversion of furnaces to 90% efficient units	12	80.0
Solar: Hydro or Photovoltaic	5	33.3
Insulation/Windows	14	93.3
Other	8	53.3

The evaluation of an energy savings project may utilize one or several rating categories. The CHAs were asked to identify as many different methods used to evaluate their projects as applied. The results are as shown in Figure 5.

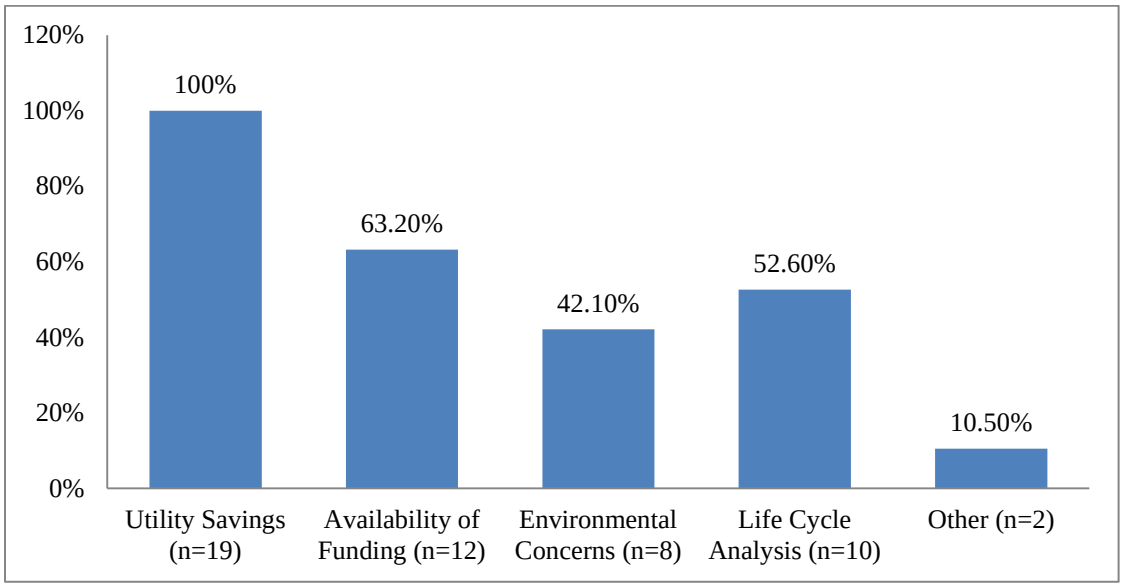

Figure 5. How Energy Projects are Evaluated.

How CHAs prioritize projects, and where energy was rated in importance as part of the CHA decision making process, required a survey question to establish where energy fit into the ranking of five categories inclunding: cost, resident needs, age of property, energy savings, and other. The respondents were asked to check the best answer and the results of this survey question are reflected in Figure 6.

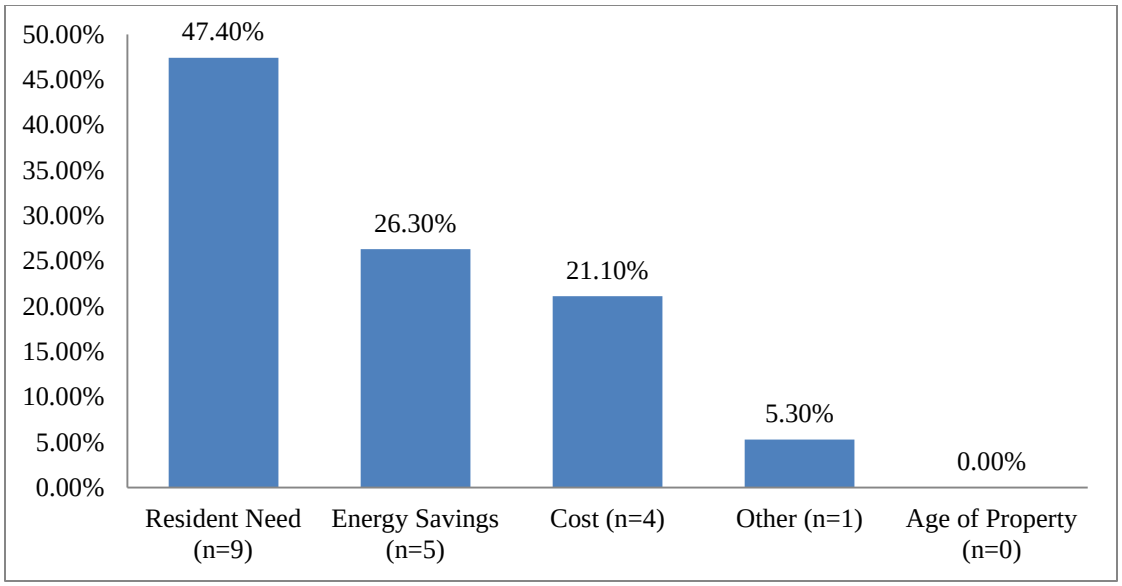

Figure 6. How Projects are Prioritized

Third Party Consultants

The contracting, or consideration of contracting, of third party consultants for the design and implementation of energy projects would seem to be a prudent business decision for any business, be it private or public. Of course, this would be determined by the size and complexity of the energy project. The CHAs were asked if they had contracted, or considered contracting, the services of a third party consultant (i.e. engineer or architect). Close to one-half of the CHAs (42.1%) have contracted for third party services; slightly more than 22% of CHAs have considered, but never used, third party services. Slightly more than one-third of the respondents (36.8%) have never contracted with a third party consultant.

Energy Usage Responsibility

As housing stewards for Colorado residents, the CHAs have an implied responsibility to minimize energy and resource consumption at all of their properties as well as commercial office and maintenance facilities. This section reviews the responses

to survey questions related to how proactively the CHAs are responding to the need to concerve energy.

The lowering of energy consumpsion should be the ultimate goal of good stewardship for CHAs. This would be the result of planning for future projects to achieve this goal and the CHAs were asked if they planned to implement energy savings projects in coming years; or have not considered implementing energy saving projects. The results to this question are reflected in Figure 7.

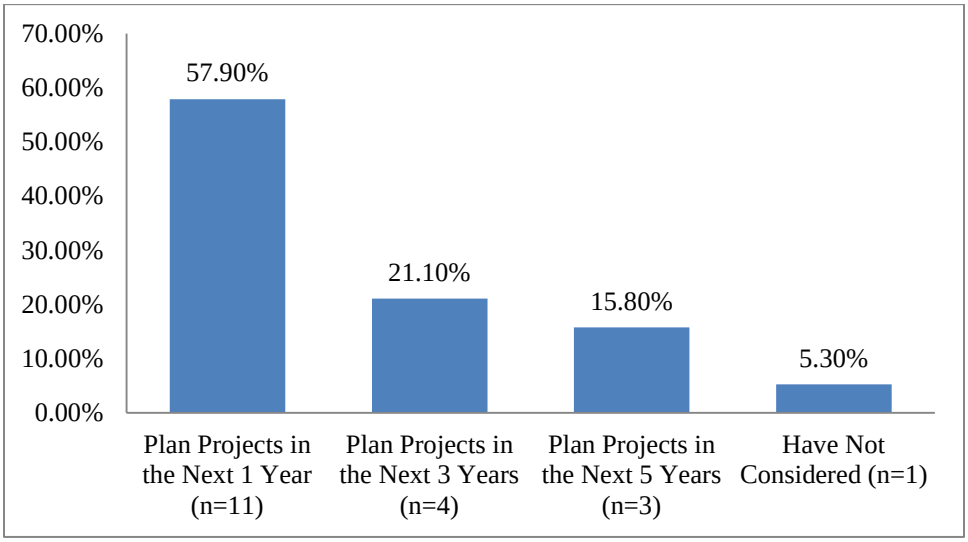

Figure 7. Timeline to Implement Energy Saving Projects

CHAs were questioned about alternate forms of energy production; 57.9% (*n*=11) of the respondents had considered alternative forms of energy production for their properties while 42.1% (*n*=8) had not.

Two survey questions addressed alternate energy production: "the forms of alternative energy production the CHA has *considered*" and "the alternative forms of energy production the CHA has *installed*" at their property or properties. The responses have been combined into one figure to compare and contrast the *considered* and the *installed* (Figure 8).

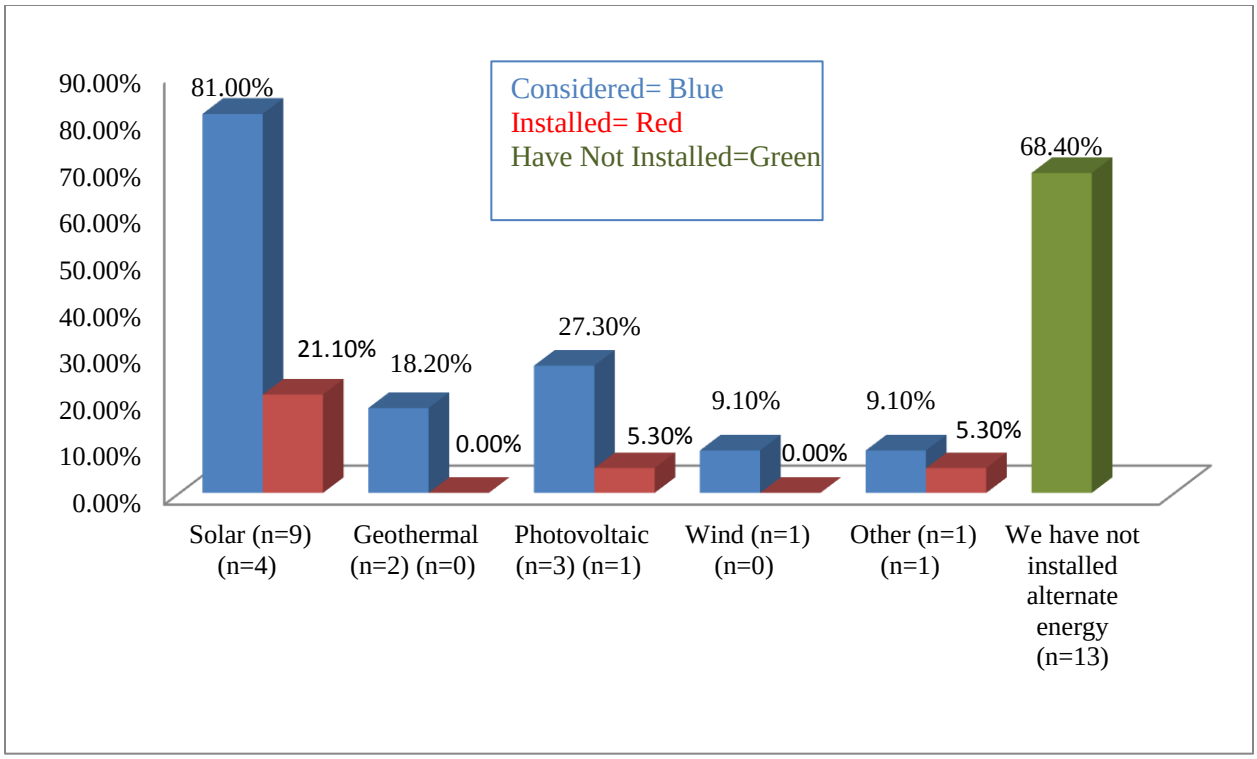

Figure 8. Alternative Forms of Energy Production

Education and Incentives

The survey questions addressing education and incentives were designed to evaluate how CHAs involve the residents and employees in energy conservation through education and the collection and disbursement of energy data.

CHAs were surveyed as to what percentage of their residents pay their own utility bills, excluding water and sewer. The data collected reveals an average of 36.7% of the responding CHAs' residents pay their own utility bills.

Three survey questions were directly related to monitoring utility bills, monitoring utility consumption, and sharing that information with the residents. The questions were presented in a "yes" or "no" format. Figure 9 shows the relationship between the monitoring, types of data collected, and the sharing of information with residents.

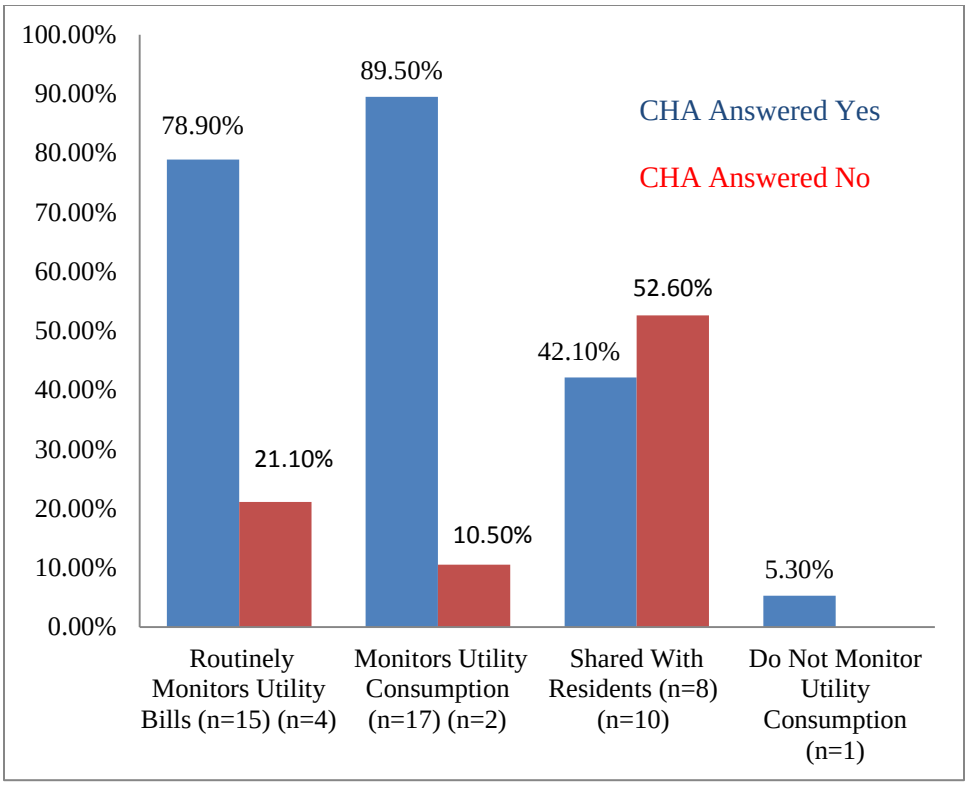

Figure 9. Monitoring of Utility Bills and Consumption/Sharing of Utility Data with Residents

CHAs were also asked if measures had been taken to educate the employees and residents with regards to energy conservation as shown in Figure 10.

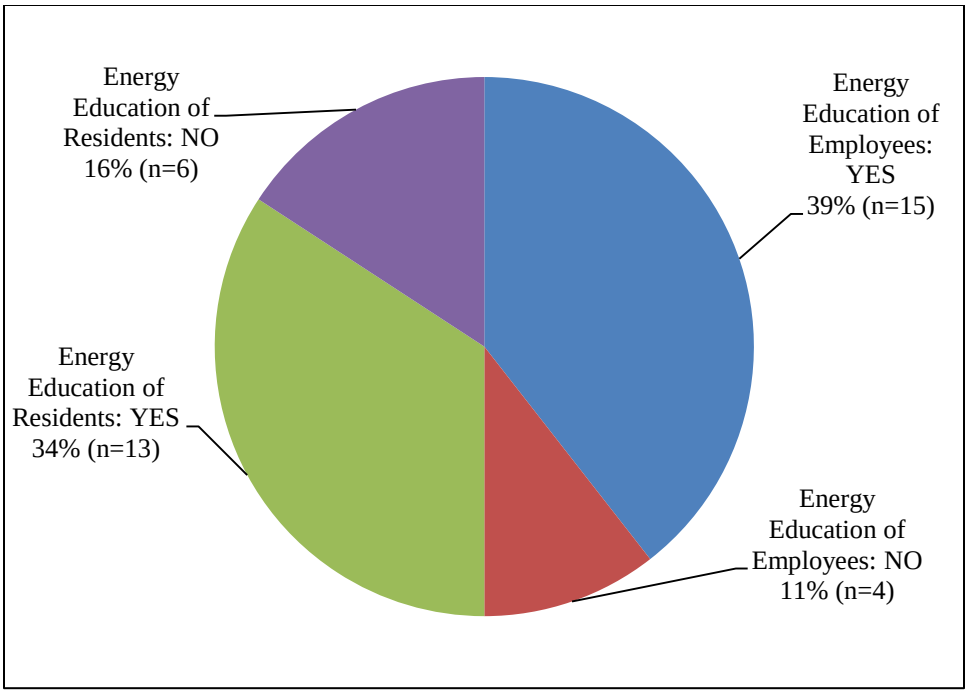

Figure 10 Energy Conservation Education of Employees and Residents

A question concerning the CHAs' adminstration and maintenance facilities was included in the survey. The CHAs were asked if they have taken measures to reduce utility consumption in their administration and maintenance buildings, for example, installing Compact Fluorescent (CFL) bulbs, performing regular HVC maintenance, and adjusting thermostats. Responses are shown in Figure 11.

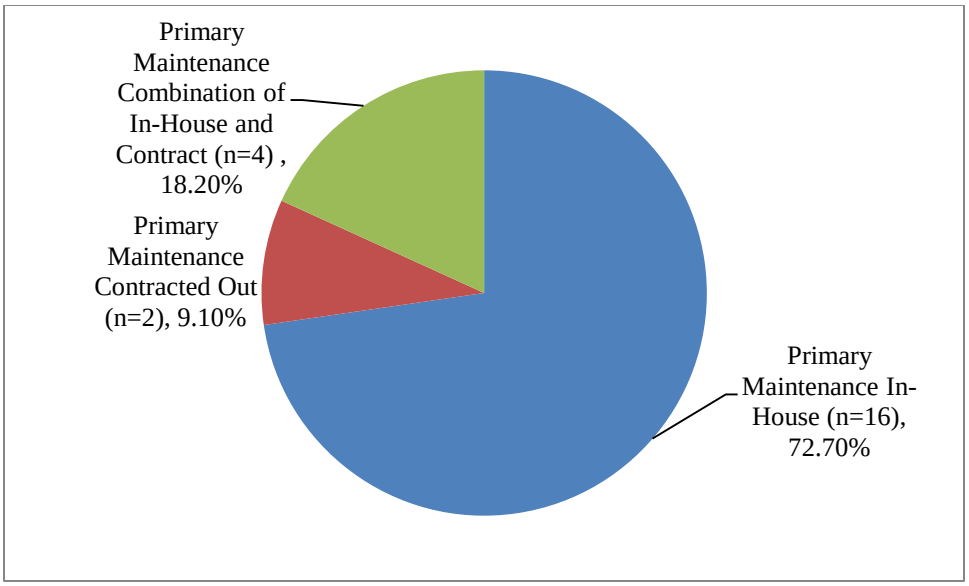

Figure 11. Reduced Utility Consumption Efforts Performed

Comments from CHAs

The final two questions requested the survey participants to (a) provide any additional information they wished to share concerning the use and application of green technology at their CHAs, and (b) provide any comments they wished to share about the survey in general. Three CHAs responded to the first question. The responses were:

> The Housing used the ARRA to install all new energy saving furnaces. We have also recently had new insulation blown into all apartments. If we are asked to replace light bulbs, energy saver light bulbs are used.
>
> At present we are planning to renovate a 32-year old CHFA property and hope to be able to do some voltaic energy projects.
>
> We have been approved through GEO and EOC for energy conservation measures; however the work has not begun. We will be doing boiler replacement, reverse indirect DHW with a solar DHW integration.

Two CHAs responded to the second question asking for comments on the survey in general. The responses were:

> "Wishing you the best of luck with you educational endeavors."
>
> "Would like to see the information how many Housing Authorities are going green ."

CHAPTER 5 – SUMMARY AND DISCUSSION

Introduction

The research question for this study was " What is the current state of energy conservation of CHAs?" The purpose was to collect data in order to document current efforts by CHAs to manage energy usage through implementation of green energy technology, funding resources, and education of residents and employees. It was also to establish a baseline for future research. The data collection was based on a census approach to ensure accurate representation of all CHAs identified in the Housing Authority Directory published by the Colorado Division of Housing. A 53% response rate was achieved from CHAs that manage physical properties within the state; this number represented 22 CHAs managing more than 4,000 housing units. While no clear cut conclusions were observed in this study, the data suggests that CHAs are sincerely interested in energy technology implementation, funding, and education; future follow up surveys will be necessary to define patterns identified in this research. In the following section, the researcher will examine and comment on specific responses of the CHAs as they pertain to each of the survey divisions and the corresponding survey questions identified in Table 1 (Chapter 3).

Conclusions

General Property Information

It is important to note that of the 4,539 single or multi-family units, 2,802 (61.73%) identified in this study were 16 years or older, and of those units, 1,793

(39.50%) were constructed more than 30 years ago. Buildings of this era typically were not built with energy conservation as a high priority in their design and construction. It can be assumed these buildings, if not retrofitted with current energy technology, are badly in need of energy efficient upgrades in the areas of heating and air conditioning, windows, and insulation. Additional investigation will be required to assess the level of energy conversions that has taken place in the older structures and what, if any, retrofit projects are in the planning stages. The additional investigation into results from energy audits of the properties would be interesting.

Another area of focus for future research is the comparison of types of funding of properties and the level of involvement that property partners, owners, and managers have in energy conservation. The three types of funding referenced in this survey were: federal funding (HUD), private funding and ownership, and tax credit funding.

Project Funding

An important resource for funding of energy projects is grant writing. A majority of respondents 68.2% (*n*=15) stated they actively write grants; 31.8% (*n*=7) stated they do not actively write grants. Of those CHAs reporting they do not write grants, 50% (*n*=3) stated they are not knowledgeable of funding resources. This is an indication the CHA industry should investigate the reasons CHAs are not knowledgeable of funding resources as well as what steps might be taken to improve their understanding of grant resources.

Not understanding the sources of energy grant funding appears to be only one of the obstacles for receiving the necessary funds to implement energy projects; one of the respondents identified a lack of technical grant writing abilities as why they did not write

grants. The possible answer to this problem may be for the CHAs to provide their employees access to grant writing education opportunities through public institutions, such as colleges or universities offering grant writing classes, or to contract private companies offering similar classes. An additional possibility for CHAs is to hire private companies offering grant writing services for a fee. Additional research would be required to determine which avenues to pursue.

Some grant funding agencies may require a CHA applying for funding to provide matching funds as a condition to funding a project. The data suggests that most CHA's matching funds for energy projects are found in either the reserve funds account 52.6% (*n*=10), or the operations account 42.1% (*n*=8). The data also suggests that 26.3% (*n*=5) of the responding CHAs do not have matching funds available for energy projects. As it is assumed that matching funds are necessary to compete for energy funding, a reasonable assumption would be that future research would be necessary in assessing why the CHAs do not have matching funds available and what processes might be put into place to ensure future funds be available for investing in energy grants.

Addressing why the CHA respondents have not impllemented projects designed to reduce energy consumption 53 % (*n*=10) answered "No Reason," while no participant answered "Not knowledgable in energy conservation." This data would suggest a need to to follow-up with an attitudes/norms study.

Energy Projects: Past, Current, and Future

The data identified HUD as the major source of funding for CHA energy projects followed by Energy Outreach Colorado, Community Development Grants, and the Governor's Energy Office. When asked which of the types of funding the CHAs utilized

in the past 24 months, the data reported Energy Outreach Colorado as the major funding agency with HUD second. Researching economic trends of the funding agencies may be of a great benefit to the CHAs when applying for energy grant funding.

It is important to note 20% (*n*=4) of the CHA respondents indicated the inportance of using *Energy Star* appliances was either "somewhat important" or the respondant was "neutral". With regard to utilizing *Energy Star* appliances in projects designed to reduce utility consumption, the data suggests the CHAs feel the use of *Energy Star* appliances is very important. However, the cost of the *Energy Star* appliances is a factor for a number of the CHAs. Continuing research would be suggested to moniotor the current and future trends as the costs of *Energy Star* appliances drop.

Prioritizing Energy Projects

CHAs were asked to identify the best reason why they have not implemented projects designed to reduce utility consumption. The data reveals that 52.6% (*n*=10) of the respondents did not have a reason why they have not implemented projects designed to reduce energy consumption. This may be an indication the respondents did not understand the question and the question should be re-stated in future research. The respondents' answer may disclose that the responding CHAs in fact do not have a reason for not implementing projects designed to reduce utility consumption and presents a topic for future research.

Third Party Consultants

The use of the third party consultants can be benefical to CHAs in the funding and construction of enery projects. For example, a professional grant writer familiar with the different funding agency requirements could be a benefit to the CHA considering

different funding oppertunities. Defining the scope of work for heating and cooling of a project might best be achieved using a professional architect and/or engineer to achieve the best results at the most equitable costs.

The data shows 36.8% (*n*=7) have never considered using a third party consultant. Not using an engineer or architect in the planning of remodel and new construction projects may play a large part in why certain CHAs are not successful in initiating projects. The relationship between successful planning, funding, and completion of energy projects and the use of third party consultants would be a research project worth exploring.

Energy Usage Responsibility

The data from the questions in this division (identified in Table 1, Chapter 3), would suggest the reporting CHAs are proactive in their efforts to conserve energy. The majority of CHA respondents appear to have plans in the next year to implement energy saving projects. In addition to planning future energy saving projects, 52.6% (*n*=10) of the respondents stated they evaluate energy projects using Life Cycle Analysis. Other positive responses include the percentage of CHAs who have considered alternative forms of energy production and those who have actually installed alternative energy sources such as solar collectors. On-going monitoring of these responses should continue in the future.

One question where the data suggests more research is warranted is the question of how CHAs prioritize projects. The answers provided were: cost, resident needs, age of property, energy savings, and other; “age of property” did not garner a response. Data results provided in this survey indicate that 66.9%, or 2,680 housing units currently in

use, are 15 years or older. The 'No" response vote may suggest research into the current condition of the older CHA buildings. The number of energy efficient conversions currently in place in the the older units is unknown and future research to answer this question is suggested.

Education and Incentives

CHAs reported 36.7% of their residents paid their own utility bills leaving 63.3% of the utility costs to the CHAs. A multitude of research questions emerge from this finding: "Do residents who pay their own utility bills use less energy than those residents who do not pay a utility bill?" or, "How do you educate residents to be more energy knowledgeable?"

Level of involvement of the CHAs in the areas of energy education and incentives is mixed based on the responses to the survey questions. CHAs appear to be diligent in monitoring utility consumption and utility bills. But when asked, only 42.1% (n=8) of the CHAs stated they shared utility consumption information with the residents. It would seem the CHAs are missing an opportunity to address energy consumption issues by not sharing utility consumption and utility bills with residents. Research into current and future forms of energy conservation education and incentives provided to residents and employees seems necessary. The data suggests the CHAs are working towards reducing energy usage in their own administrative and maintenance buildings.

Comments from CHAs

A total of five CHAs responded to the two comment sections. Three of those referenced future CHA projects. The lack of response might indicate the majority of CHAs are not planning for specific energy projects. This response suggests additional

research into the planning processes used by the CHAs for future energy projects would be appropriate.

Summary

The survey data and conclusions will be reported to CHAs as well as other interested parties such as the Governors Energy Office and Energy Outreach Colorado. The short term outcome of this study is to encourage the CHAs to consider the use of green technologies. The long term expectation is that CHAs that understand the advantages of green energy technologies, know possible funding resources, and are able to educate residents and employees, are more likely to implement these technologies.

For CHAs to understand how the industry is performing it is important the information gathered in this survey be revisited. Several research opportunities have been outlined that may give CHAs a better understanding of future grant and funding issues, use of energy technology, and energy education opportunities.

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APPENDIX A

Colorado Public Housing Authority Directory

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Department of Local Affairs
Colorado Division of Housing
1313 Sherman Street, Room 518
Denver, CO 80203
(303) 866-2033

Colorado Housing Authorities

Housing Authority of Adams County
E-Mail: aarmendariz@achaco.com
7190 Colorado Blvd, 6th Floor, Commerce City, CO 80022
Phone: (303) 227-2075Fax: (303) 227-2098

Housing Authority of the Town of Aguilar
E-Mail: CHA@fone.net
300 W. Main Street, Aguilar, CO 81020
Phone: (719) 941-4357 Fax:

Housing Authority of the City of Akron
E-Mail:
P. O. Box P, Akron, CO 80720
Phone: (970) 345-6538 Fax :(970) 345-6538

Housing Authority of the City of Alamosa
E-Mail: CHA@fone.net
213 Murphy Drive, Alamosa, CO 81101-2348
Phone: (719) 589-6694 Fax: (719) 589-8474

Housing Authority of the Town of Antonito
E-Mail: vqc@amigo.net
525 River, Antonito, CO 81120-0025
Phone: (719) 376-5487 Fax: (719) 376-5405

Housing Authority of the County of Arapahoe
E-Mail: housingauthority@co.arapahoe.co.us
1690 W. Littleton Blvd, Littleton, CO 80120
Phone: (303) 738-8060 Fax: (303) 738-8069

Housing Authority of the City of Arvada
E-Mail: ed-t@ci.arvada.co.us
8001 Ralston Road, Arvada, CO 80002
Phone: (720) 898-7435 Fax: (720) 898-7490

Housing Authority of the County of Aspen / Pitkin
E-Mail: cindy.christensen@ci.aspen.co.us
530 E. Main St., Aspen, CO 81611
Phone: (970) 920-5050 Fax: (970) 920-5580

Housing Authority of the City of Aurora
E-Mail: craber@aurorahousing.org
10745 E. Kentucky Ave, Aurora, CO 80012
Phone: (303) 539-8717 Fax: (303) 340-1972

Housing Authority of the County of Boulder
E-Mail: droybal@ bouldercounty.org
400 East Simpson, Suite 202, Lafayette, CO 80026
Phone: (303) 665-9244 Fax: (303) 665-0364

Boulder Housing Partners
E-Mail: johnsont@boulderhousingpartners.org
3120 Broadway Street, Boulder, CO 80304
Phone: (303) 441-3150 Fax: (303) 939-9569

Housing Authority of the City of Brighton
E-Mail: bha@brightonco.gov
22 S 4th Ave. Room #101, Brighton, CO 80601-2030
Phone: (303) 655-2160 Fax: (303) 655-2152

Housing Authority of the City of Brush
E-Mail: brushhousing@brushhousing.com
418 Edison Street, Brush, CO 80723
Phone: (970) 842-5046 Fax: (970) 842-5007

Housing Authority of the Town of Burlington
E-Mail: erker@centurytel.net
944 Lowell Ave., Burlington, CO 80807
Phone: (719) 346-5464 Fax: (719) 346- 5077

Housing Authority of the Town of Calhan
E-Mail: CHou150186@aol.com
406 Cheyenne Street, Calhan, CO 80808
Phone: (719) 347-2616 Fax: (719) 347-3242

Housing Authority of the Town of Center
E-Mail: housing@centurytel.net
P.O. Box 759, Center, CO 81125
Phone: (719) 754-2537 Fax: (719) 754-2477

Housing Authority for the Town of Cheyenne Wells
E-Mail: cwha@rebeltec.net
1245 N 1st ST. W Suite 36, Cheyenne Wells, CO 80810
Phone: (719) 767-5964 Fax: (719) 767-5396

Housing Authority of the City of Colorado Springs
E-Mail: jmb@csha.us
P.O. Box 1575, Colorado Springs, CO 80901-1575
Phone: (719) 387-6700 Fax: (719) 632-7807

Housing Authority of the City of Commerce City
E-Mail: chousing@c3gov.com
7887 E 60th Ave., Commerce City, CO 80022
Phone: (303) 289-3696 Fax: (303) 289-3731

Housing Authority of the County of Conejos
E-Mail: rabbit44@centurytel.net
510 Richfield Rd, La Jara, CO 81140
Phone: (719) 274-5417 Fax: (719) 274-0417

Housing Authority of the County of Costilla
E-Mail: ccha@fonenet.com
510 Richfield, CO 81140
Phone: (719) 274-5417 Fax: (719) 672-0145

Housing Authority of the City of Delta Housing
E-Mail: info@deltahousing.org
501 14th Street, Delta, CO 81416
Phone: (970) 874-7266 Fax: (970) 874-8612

Housing Authority of the City of Denver
E-Mail: dwarne@denverhousing.org
777 Grant St., Denver, CO 80203
Phone: (720) 932-3000 Fax: (720) 932-3001

Douglas County Housing Partnership
Email: tanderso@douglas.co.us
100 3rd ST, Castle Rock, CO 80104
Phone: 303-814-2965 Fax: 303-814-2966

Housing Authority of the Town of Eads
E-Mail: eadshousing@bemail.com
P.O. Box 8, Eads, CO 81036
Phone: (719) 438-5590 Fax: (719) 438-5652

Housing Authority of the Town of Eagle
E-Mail: jill.klausterman@eaglecounty.us
500 Broadway, Eagle, CO 81631
Phone: (970) 328-8730 Fax: (970) 328-7185

Housing Authority of the Town of Eaton
E-Mail: gcarsten@eatonco.org
223 First Street, Eaton, CO 80615
Phone: (970) 454-3338 Fax: (970) 454-3339

Housing Authority of the County of El Paso
E-Mail: deannemccann@elpasoco.com
105 East Vermijo Suite 200, Colorado Springs, CO 80903
Phone: (719) 520-6480 Fax: (719) 520-6486

Housing Authority of the City of Englewood
E-Mail: dshepherd@englewoodhousing.org
3460 S. Sherman St. Suite 101, Englewood, CO 80110
Phone: (303) 761-6200 Fax: (303) 781-5503

Housing Authority of the Town of Erie
E-Mail: nparker@erieco.gov
PO Box 750, Erie, CO 80516
Phone: (303) 926-2731 Fax:

Estes Park Housing Authority
E-Mail: rkurelja@estes.org
170 Macgregor Avenue, Estes Park, CO 80517
Phone: (970) 577-3730 Fax:

Housing Authority of the City of Flagler
E-Mail: pionneerv@plainstel.com
511 Quandry Avenue, Flagler, CO 80815-9238
Phone: (719) 765-4899 Fax: (719) 765-4886

Fort Collins Housing Authority
E-Mail: jvolloric@fcgov.com
1715 W Mountain Ave., Fort Collins, CO 80521
Phone: (970) 221-5484 Fax: (970) 221-0821

Housing Authority of the City of Fort Lupton
E-Mail: fortluptonhousing@comcast.net
400 2nd St., Fort Lupton, CO 80621
Phone: (303) 857-4400 Fax: (303) 857-6847

Housing Authority of the City of Fort Morgan
E-Mail: hafm@qwestoffice.net
1100 Linda St., Fort Morgan, CO 80701
Phone: (970) 867-2734 Fax: (970) 867-7303

Housing Authority of the City of Fountain
E-Mail: fountha@di-net.com
501 E. Iowa Ave., Fountain, CO 80817
Phone: (719) 382-5639 Fax: (719) 382-4113

Housing Authority of the County of Garfield County
E-Mail: gchauthority@qwestoffice.net
2128 Railroad Ave., Rifle, CO 81650
Phone: (970) 625-3589 Fax: (970) 625-0859

Housing Authority of the Town of Granada/Holly
E-Mail:
P.O. Box 258, Granada, CO 81041
Phone: (719) 537-0191 Fax:

Housing Authority of County of Grand
E-Mail: jsheehan@grandhousinng.org
P.O. Box 2560, Fraser, CO 80442
Phone: (970) 726-4572 Fax: (970) 726-4579

Housing Authority of City of Grand Junction
E-Mail: dhartman@gjhousing.org
1011 N. 10th St., Grand Junction, CO 81501
Phone: (970) 245-0388 Fax: (970) 254-8347

Housing Authority of the City of Greeley / Weld
E-Mail: tom@greeley-weldha.org
315 N 11th Ave. Building B, Greeley, CO 80631
Phone: (970) 346-7660 Fax: (970) 346-7690

Housing Authority of the County of Gunnison
E-Mail: blucero@gunnisoncounty.org
200 E. Virginia Ave, Gunnison, CO 81230
Phone: (970) 641-7900 Fax: (970) 641-7931

Housing Authority of the Town of Haxtun
E-Mail:haxtunha@kci.net
P.O. Box 95/136 S Miller, Haxtun, CO 80731
Phone: (970) 774-7251 Fax: (970) 774-6646

Housing Authority of the Town of Holly
E-Mail:
P.O. Box 486, Holly, CO 81047
Phone: (719) 537-6050 Fax: (719) 537-6875

Housing Authority of the Town of Holyoke
E-Mail: holyokeh@pctelcom.coop
330 West Kellogg St., Holyoke, CO 80734
Phone: (970) 854-2289 Fax: (719) 854-2245

Housing Authority of the City of Hudson
E-Mail:
P.O. Box 351/551 Ash Street, Hudson, CO 80642
Phone: (303) 536-4501 Fax: (303) 5364501

Housing Authority of the Town of Hugo
E-Mail: hugohousing@plains.net
P.O. Box 305, Hugo, CO 80821
Phone: (719) 743-2174 Fax: (719) 743-2447

Housing Authority of the County of Jefferson
E-Mail: jeffcohsg@aol.com
7490 W. 45th Ave, Wheat Ridge, CO 80033
Phone: (303) 422-8600 Fax: (303) 422-3229

Housing Authority of the Town of Johnstown
E-Mail:
P.O. Box 306/202 N Greeley, Johnstown, CO 80534
Phone: (970) 587-2600 Fax: (970) 587-2600

Housing Authority of the Town of Julesburg
E-Mail: julehous@pctelcom.coop
520 West 9th Street, Julesburg, CO 80737
Phone: (970) 474-3675 Fax: (970) 474-2072

Housing Authority of the Town of Keensburg
E-Mail: keenehousing@aol.com
P.O. Box 367, Keensburg, CO 80643
Phone: (303) 732-4221 Fax: (303) 732-0979

Housing Authority of the Town of Kersey
E-Mail: kerseyha@mindspring.com
109 1st Ave., Greeley, CO 80644
Phone: (970) 351-8229 Fax: (970) 336-1178

Housing Authority of the City of La Junta/Otero Housing
E-Mail: ljhous@yahoo.com
315 E. 5th St., La Junta, CO 81050
Phone: (719) 384-9055 Fax: (719) 384-7221

Housing Authority of Lamar
E-Mail: scranton@lamarhousing.org
804 S. Main St. Lamar, CO 81052
Phone: (719) 336-9575 Fax: (719) 336-9529

Housing Authority of the County of Larimer
E-Mail: jvolloric@fcgov.com
1715 W Mountain Ave., Fort Collins, CO 80521
Phone: (970) 221-5484 Fax: (970) 221-0821

Housing Authority of the City of Las Animas
E-Mail: whitehill@hotmail.com
427 6th Street, Las Animas, CO 81054
Phone: (719) 456-2748 Fax: (719) 456-2744

Housing Authority of the City of Leadville
E-Mail: massive@colorado.net
112 West 5th Street, Leadville, CO 80461
Phone: (719) 486-2431 Fax:

Housing Authority of the City of Limon
E-Mail: lhauthority1001@qwestoffice.net
1880 Circle Lane, Limon, CO 80828
Phone: (719) 775-9309 Fax: (719) 775-9309

Housing Authority of the City of Littleton
E-Mail: ebarnes@hotmail.com
5844 S. Datura St., Littleton, CO 80120
Phone: (303) 794-9608 Fax: (303) 798-6244

Housing Authority of the City of Longmont
E-Mail: marv@longmontha.com
900 Coffman St. Suite C, Longmont, CO 80501
Phone: (303) 651-8581 Fax: (303) 682-5421

Housing Authority of the City Loveland
E-Mail: mhers@lovelandhsg.org
375 W 37th St., Loveland, CO 80538
Phone: (970) 667-3232 Fax: (970) 278-9904

Housing Authority of the City of Meeker
E-Mail: mha@nctelcom.quik.net
875 Water Street, Meeker, CO 81641
Phone: (970) 878-5536 Fax: (970) 878-5536

Metro West Housing Solutions
E-mail: mikher@mwhsolutions.org
575 Union Boulevard
Lakewood, CO 80228

Housing Authority of Moffat County
E-Mail: ujantz@moffitcounty.net
633 Ledford Street, Craig, CO 81625
Phone: (970) 824-3660 Fax: (970) 824-1199

Housing Authority of the City of Monte Vista
E-Mail: mvha04@yahoo.com
P.O. Box 581, Monte Vista, CO 81144
Phone: (719) 852-5505 Fax: (719) 852-9873

Housing Authority of the County of Montezuma
E-Mail: hamntz@beyondbb.com
37 N. Madison St., Cortez, CO 81321
Phone: (970) 565-3831 Fax: (970) 565-0860

Housing Authority of the City of Montrose
E-Mail: mcha@montrose.net
222 Hap Court, Olathe, CO 81425
Phone: (970) 323-5445 Fax: (970) 323-6179

Housing Authority of the Mt. Crested Butte
E-Mail: darwood@mtcrestedbutte-co.gov
P.O. Box Drawer D, Mt. Crested Butte, CO 81225
Phone: (970) 349-6632 Fax: (970) 349-6326

Housing Authority of the City of Pueblo
E-Mail: mike.higbee@hapueblo.org
1414 N. Santa Fe Ave., Pueblo, CO 81003
Phone: (719) 544-6230 Fax: (719) 546-5364

Housing Authority of the Town of Rangely
E-Mail: rangelyinfo@rangelygovt.com
209 E main Street, Rangely, CO 81648
Phone: (970) 675-8477
Fax: (970) 675-8471

Housing Authority of the City of Rifle
E-Mail: hudhouse@qwestoffice.net
250 Ute, Rifle, CO 81650
Phone: (970) 625-3974 Fax:

Housing Authority of the City of Rocky Ford
E-Mail: tracylovato@yahoo.com
P.O. Box 849, Rocky Ford, CO 81067
Phone: (719) 254-6902 Fax: (719) 254-6867

Housing Authority of the City of Saguache
E-Mail: housing@saguachecounty-co.gov
P.O. Box 201, Saguache, CO 81149
Phone: (719) 655-2804 Fax: (719) 655-2635

Housing Authority of the City of Salida
E-Mail: salidaha@bresnan.net
525 W 16th St., Salida, CO 81201
Phone: (719) 539-6243 Fax: (719) 539-5317

Housing Authority of the City of Sheridan
E-Mail: dshepherd@englewoodhousing.org
4101 S. Federal Boulevard, Sheridan, CO 80110
Phone: (719) 539-6243 Fax: (303) 781-5503

Housing Authority of the Town of Springfield
E-Mail:
680 West 6th Avenue, Springfield, CO 81073
Phone: (303) 761-6200 Fax: (719) 523-4211

Housing Authority of the City of Sterling
E-Mail: debbie@sterlinghousing.org
1200 N. 5th Street, Sterling, CO 80751
Phone: (970) 522-0869 Fax: (970) 522-6902

Southwest Community Resources
Email: acohen@swhousingsolutions.com
295 Giard, Durango, CO 81301
Phone: (970) 259-1086 ext. 16 Fax (970) 259-2037

Housing Authority of the County of Summit
E-Mail: jenniferk@summithousing.us
106 N. Ridge St., Breckenridge, CO 80424
Phone: (970) 423-3557 Fax: (970) 453-3554

Telluride – San Miguel Regional Housing Authority
E-Mail: shirley@smrha.org
P.O. Box 840, Telluride, CO 81435
Phone: (970) 728-3034 Fax: (970) 728-5371

Housing Authority of the City of Trinidad
E-Mail: trihou@activematrix.net
128 W 1st St., Trinidad, CO 81082
Phone: (719) 846-7204 Ext 6 Fax: (719) 846-8217

Housing Authority of the City of Walsenburg
E-Mail: wha@bresnan.net
220 Russell Ave., Walsenburg, CO 81089
Phone: (719) 738-2720 Fax: (719) 738-2258

Housing Authority of the Town of Walsh
E-Mail:
105 E. Maplewood, Walsh, CO 81090
Phone: (719) 324-5625 Fax:

Housing Authority of the Town of Wellington
E-Mail: jvolloric@fcgov.com
1715 W Mountain Ave., Fort Collins, CO 80521
Phone: (970) 221-5484 Fax: (970) 221-0821

Housing Authority of the Town of Wiley
E-Mail: wileytown@centurytel.net
P.O. Box 519, Wiley, CO 81092
Phone: (719) 829-4974 Fax:

Housing Authority of the City of Windsor
E-Mail: windsorhousingauthority@gmail.com
1027 Walnut, Windsor, CO 80550
Phone: (970) 686-5576 Fax: 970-674-8833

Housing Authority of the City of Wray
E-Mail: wrayven@plains.net
722 Hale St., Wray, CO 80758
Phone: (970) 332-4238 Fax: (970) 332-4238

Housing Authority of the Town of Yuma
E-Mail: jkdevlin@plains.net
700 W 3rd Ave, Yuma, CO 80759
Phone: (970) 848-5590 Fax: (970) 848-5590

APPENDIX B

Colorado Housing Authority (CHA) Energy Survey

1. Which Colorado Housing Authority are you representing?

Name_____

_____

2. What is the approximate distribution of properties types in your HA? Enter the number of units below.

- Multi-family: Number of buildings/number of unit_____/_____
- Single family homes (number of homes)_____

3. What is the approximate distribution of property funding for your Colorado Housing Authority (CHA) units? Please provide the approximate percentage below. For example, enter 25 for 25 percent.

- Self-funded_____%
- Tax Credit_____%
- Public Housing (HUD)_____ %

4. Identify total number of individual Housing Authority units by age of property:

- 0-5 yrs:_____ units
- 6-10 yrs: _____units
- 11-15 yrs: _____units
- 16-20 yrs: _____units
- 21-30 yrs: _____units
- 31+yrs: _____units

5. How is property maintenance generally handled at your CHA? (check one)

- ( ) Primary maintenance is performed in-house property, i.e. property management.
- ( ) Primary maintenance is contracted out.
- ( ) Primary maintenance is a combination of in-house and outside contracts.

6. Does your CHA actively write grants and/or solicit funding for energy projects?

- ( ) Yes
- ( ) No

7. Select the best reason below for why your CHA does not actively write grants and/or solicit funding for energy projects.

- ( ) Not knowledgeable of funding resources.
- ( ) Don't have writing abilities.
- ( ) CHA does not meet specific funding qualifications.
- ( ) Other (please specify)_____

8. Identify how your CAH's energy projects are funded: (check all that apply)

- ( ) Governors Energy Office
- ( ) Energy Outreach Colorado
- ( ) Colorado Department of Local Affairs
- ( ) Community Development Block Grants
- ( ) Energy and Environmental Block Grant
- ( ) Housing and Urban Development
- ( ) Have not received funding

- ( ) Other (please specify)

  _____

9. What types of energy grant funding has your CHA applied for in the past 24 months? (check all that apply)

- ( ) Governors Energy Office
- ( ) Energy Outreach Colorado
- ( ) Colorado Department of Local Affairs
- ( ) Community Development Block Grants
- ( ) Energy and Environmental Block Grant
- ( ) Housing and Urban Development
- ( ) None
- ( ) Other (please specify)

  _____

10. How important is it for your CHA to use *Energy Star* rated appliances when replacing appliances? Level of importance

- ( ) Not very important ( ) ( ) ( )Neutral ( ) ( ) ( )Very Important

11. In the past 12 months what is the single best reason why your CHA chose <u>not</u> to purchase *Energy Star* appliances (i.e., cost or availability):_____

12. Has your CHA implemented projects designed to reduce utility consumption?

- ( )Yes
- ( ) No

13. Which of the following projects types has your CHA implemented? (check all that apply)

- ( ) Lighting projects, i.e. CFLs, T-12 conversions
- ( ) Conversion of furnaces to 90+ efficient units
- ( ) Solar: Hydro or Photovoltaic
- ( ) Insulation/Windows
- ( ) Other

_____

14. Check the best reason why your CHA has not implemented projects designed to reduce utility consumption?

- ( ) Lack of funding or matching funds
- ( ) Not knowledgeable where or how to apply for funding
- ( ) Not knowledgeable in energy conservation
- ( ) No reason
- ( ) Other

_____

15. In the past two (2) years, has your CHA implemented an energy related project that is not expected to reduce energy consumption, (i.e. furnace replacement, water heater replacement that is not Energy Star rated)?

- ( ) Yes
- ( ) No

16. When your CHA implemented an energy related project that was not expected to reduce energy usage, was energy saving alternative considered (i.e. 95% efficient vs. 80% efficient furnace, *Energy Star* vs. standard appliances)?

- ( ) Yes
- ( ) No
- ( ) We have not implemented energy projects that are expected to reduce energy costs.

17. Does your CHA plan to implement energy saving projects in the next:

- ( ) 1 year
- ( ) 3 years
- ( ) 5 years
- ( ) Have not considered

18. How does your CHA evaluate energy saving projects? (check all that apply)

- ( ) Utility savings
- ( ) Environmental concerns
- ( ) Availability of funding
- ( ) Life Cycle Analysis
- ( ) Other

_____

19. How does your CHA prioritize energy projects? (check the best answer)

- ( ) Cost
- ( ) Resident needs
- ( ) Age of property

- ( ) Energy savings
- ( ) Other

_____

20. Has your CHA considered alternative forms of energy production?

- ( ) Yes
- ( ) No, we have not considered alternative forms of energy production.

21. What alternative forms of energy production has your CHA CONSIDERED? (check all that apply)

- ( ) Solar
- ( ) Geothermal
- ( ) Photovoltaic
- ( ) Wind
- ( ) Other (please specify) _____

22. What alternative forms of energy production has your CHA installed?

- ( ) Solar
- ( ) Geothermal
- ( ) Photovoltaic
- ( ) Wind
- ( ) Other (please specify) _____
- ( ) We have not installed alternative forms of energy production

23. Has your CHA contracted or considered the services of a third party energy consultant (i.e. engineer, architect)?

- ( ) Have contracted

- ( ) Considered but did not use
- ( ) Never contracted

24. What percentage of your CHA residents pay their OWN utility bills (excluding water and sewer)?

- _____%

25. Does your CHA routinely monitor utility bills?

- ( ) Yes
- ( ) No

26. Does your CHA monitor utility consumption (i.e. therms, kilowatt hours, gallons)?

- ( ) Yes
- ( ) No

27. Is utility consumption data is shared with residents?

- ( ) Yes
- ( ) No
- ( ) We do not monitor utility consumption.

28. Has your CHA taken measures to educate your <u>employees</u> with regards to energy conservation?

- ( ) Yes
- ( ) No

29. Has your CHA taken measures to educate your <u>residents</u> with regards to energy conservation?

- ( ) Yes
- ( ) No

30. Has your CHA actively taken measures to reduce utility consumption in your administration and maintenance buildings (i.e. installing Compact-Florescent (CFl) bulbs, regular HVAC maintenance, adjusting thermostats)?

- ( ) Administration ONLY
- ( ) Maintenance ONLY
- ( ) Administrative and maintenance buildings

31. What kind of "matching funds" does your CHA have available for energy projects?

- ( ) Operations
- ( ) Reserves
- ( ) Excess Rents
- ( ) Other
- ( ) Our CHA does not have matching funds available for energy products.

32. Have any of the recent ARRA Stimulus Funds received by your CHA been allocated to energy projects?

( ) Yes

( ) No

( ) Neither

33. Thank you for your responses to the above questions. Please provide any additional information you would like to share about the use and application of green technology at your

CHA._____

_____

_____

34. Are there any comments you would like to share about this survey in general? If so, please provide them below.

_____

_____

_____

APPENDIX C

Letter of Introduction

Letter of Introduction
Date: Month, Day, 2010

RE: Energy Survey

Greetings,

My name is Bill Rumley. I am the current Maintenance Supervisor for the Housing Authority of the City of Loveland in Loveland, Colorado. I am also a graduate student in Construction Management at Colorado State University, working under the direction of Dr. Mary Nobe.

As part of my thesis, *A Greener Plan for Public Housing: A Study of Colorado Housing Authority Utilization of Green Built Technology*, I am requesting Colorado Housing Authorities (CHA's) to complete a survey designed to determine their level of involvement in utilization of energy and water efficient technologies. Your participation is critical to ensuring that all critical aspects of this issue are addressed.

The results of the survey will be shared, through publication in appropriate journals, with all Colorado HAs as well as the different governmental and private agencies involved in the Green Built movement. The intent of this study is to determine the level of involvement Colorado HAs in sustainable and energy conservation, influence changes in sustainable and energy conservation funding requirements and to improve access to educational information for CHAs and their residents which will lead to lower utility usage, translating into lower energy costs.

I have included a survey for your review and at the end of the survey I have requested comments and or concerns about the survey. I hope you will take the few minutes to complete the survey. It should take you approximately 30 minutes to complete the survey. Thank you in advance for your participation. Please feel free to contact me by phone or by e-mail.

With Regards,

William Rumley
Master's Candidate
Dept. of Construction Management
rumleywj@usa.net
Cell Phone: 970-556-8119
Office: 970-635-5934

MaryEllen Nobe, Ph.D., LEED AP
Assistant Professor
Dept. of Construction Management
Mary.nobe@colostate.edu
970-491-5215

APPENDIX D

Terms and Definitions

Affordable Housing: Decent, quality housing that costs no more than 30 percent of a household's gross monthly income for rent/mortgage and utility payments (Affordable Housing, (n.d.).

Department of Housing and Urban Development (HUD): The United States federal department that administers federal programs dealing with better housing and urban renewal; created in 1965. Department of Housing and Urban Development (n.d.).

Energy Outreach Colorado (EOC): Through the Charitable Energy Network, the Low-Income Energy Assistance Program (LEAP), and Energy Efficiency Programs EOC provides long-term solutions to help needy Coloradoans control their energy use and lower their bills (Energy Outreach Colorado, (n.d.).

Energy Tax Credits: Tax credit given to encourage the conservation of natural resources, as well as the development of alternative resources (Energy Tax Credits, (n.d.).

Governor's Energy Office (GEO): The GEO's mission is to lead Colorado to a New Energy Economy by advancing energy efficiency and renewable, clean energy resources (Colorado Governors Energy Office, (n.d.).

Green Built: A design philosophy which focuses on increasing the efficiency of resource use (Green Built n.d.).

Housing Authority: A governmental body that governs some aspect of housing, often providing low rent or free apartments to qualified residents.

Low Income Housing Tax Credits: The Low Income Housing Tax Credit (LIHTC) Program was created by Congress to generate equity capital for the construction and

rehabilitation of affordable rental housing through tax incentives. Low Income Housing Tax Credits, (n.d.).

Non-Profit: Not conducted or maintained for the purpose of making a profit, a nonprofit organization, (Non-Profit, n.d.).

Public Housing: Government-owned housing unites made available to low-income individuals and families at no cost or for nominal rental rates. (Public Housing, n.d.)

Sustainable: A method of harvesting or using a resource so the resource is not depleted or permanently damaged. (Sustainable, n.d.)

APPENDIX E

Research Integrity & Compliance Review

Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

DATE: September 30, 2009
TO: MaryEllen Nobe, Construction Management
William Rumley, Construction Management
FROM: Janell Barker, IRB Administrator
Research Integrity & Compliance Review Office
TITLE: A Greener Plan for Public Housing: A Study of Colorado Public Housing Authority Utilization of Green Built Technologies
IRB ID: 056-09H **Review Date:** September 30, 2009

The Institutional Review Board (IRB) Administrator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b)(5). The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the Exempt application**, including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- **Any modification of this research should be submitted to the IRB through an email to the IRB Administrator, prior to implementing <u>any</u> changes**, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.
- **Please notify the IRB if any problems or complaints of the research occur.**
- Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.

APPENDIX F

Code Book

Note: 98 = No answer (NA); 99 = Not Valid (NV)

Property: 1 = Multi-family buildings; 2 = Multi-family units; 3 = Single family units

Funding: 1 = Self funded; 2 = Tax Credit; 3 = Public

Unit /Age: 1 = 0-5 yrs; 2 = 6-10 yrs; 3 = 11-15 yrs; 4 = 16-20 yrs; 5 = 21-30 yrs; 6 = 31 yrs+

Maintenance: 1 = In-house; 2 = Partial In-house; 3 = Contracted

Active Grant: 1 = Yes; 2 = No; 3 = If no Comment

How Funded: 1 = GEO; 2 = EOC; 3 = DOH; 4 = CDBG; 5 = HUD; 6 = Other Options; 7 = Sample of Other

Type of funds: 1 = GEO; 2 = EOC; 3 = DOH; 4 = CDBG; 5 = HUD; 6 = Other Options; 7 = Sample of Other

Energy Star: 1 = Yes; 2 = No; 3 = If no Comment

Implemented: 1 = Yes; 2 = No; 3 = If yes Comment; 4 = If no Comment

Expectation: 1 = Yes; 2 = No; 3 = If yes Comment

Consider: 1 = Yes; 2 = No; 3 = Explain

Plan Energy: 1 = 1 year; 2 = 3 years; 3 = 5 years; 4 = Have not considered; 5 = Explanation

Justified: 1 = Utility savings; 2 = Environmental Concerns; 3 = Other; 4 = Sample of other

Prioritized: 1 =Resident population; 2 = Age of property; 3 = Energy usage; 4 = Other; 5 = Sample of other

Considered: 1 = Yes; 2 = No; 3 = If yes; 3a = Solar; 3b = Geothermal; 3c = Photovoltaic; 3d = Wind; 3e = Other; 4 = Sample of Other

Installed: 1 = Yes; 2 = No; 3 = If yes; 3a = Solar; 3b = Geothermal; 3c = Photovoltaic; 3d = Wind; 3e = Other; 4 = Sample of Other

3rd Party: 1 = Have used; 2 = Considered but did not use; 3 = Never used; 4 = If Explain "Considered but did not use" or "Never used".

Utility Bills 1 = Yes; 2 = No; 3 = If no what % paid by HA?

Monitored: 1 = Yes; 2 = No; 3 = If no explain

How Monitored: 1 = Yes; 2 = No; 3 = If no explain

Energy Share: 1 = Yes; 2 = No; 3 = If no explain

Ed. Employ.: 1 = Yes; 2 = No; 3 = If no explain; 4 = If yes explain

Ed. Res.: 1 = Yes; 2 = No; 3 = If no explain; 4 = If yes explain

Incentives: 1 = Yes; 2 = No; 3 = If no explain; 4 = If yes explain

Admin. Bldg.: 1 = Yes; 2 = No; 3 = If no explain; 4 = If yes explain

Matching Funds: 1 = Yes; 2 = No; 3 = If yes explain which funds; 3a = Operations; 3b = Operating Reserves; 3c = Reserve for Replacement

Stimulus: 1 = Yes; 2 = No; 3 = Projects funded

Comments: 1 = Yes; 2 = No